Noscocomial Pneumonia

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Overview

- Definition
- Pathogenesis
- Risk factors
- Microbiology
- Diagnosis
- Treatment

Definition

- Infection of pulmonary paraenchyma
- Occurs 48-72 hrs after admission
- Excludes processes incubating prior to admission

Epidemiology

- Occurs in 5-10 cases per 1,000 admissions
- Incidence 6-20 fold higher in MV patients
- Second most common nosocomial infection
- Mortality rate approaches 70%
- Attributable mortality: 33-50%

Pathogenesis

- Host defenses impaired
- Inoculum sufficient to cause infection enters lower respiratory tract
- Virulent organism

Pathogenesis

- Routes of entry
  - Microaspiration
  - Inhalation
  - Hematogenous spread
  - Direct extension
  - Via ET tube

Pathogenesis

- Microaspiration
  - Most common route of entry
  - OP flora in hospitalized patients is distinct
  - May aspirate GI contents
  - Occurs in 45% of healthy subjects during sleep
  - 35% of moderately ill and 75% of ICU patients oropharynx colonized by EGNB

Pathogenesis

- Gross aspiration: rare
- Aerosol: Legionella, MTB
- ET tube
  - Bypass host defenses above cords
  - Impairs mucocilliary clearance
  - Secretions leak around ET tube

Risk factors

- Patient-related
  - Age
  - CNS status
  - Underlying disease (COPD, AODM)
- Infection control-related (MRSA, VRE)
- Intervention-related
  - Prolonged use abx
  - Ulcer prophylaxis
  - Tubes: ET, NG, etc

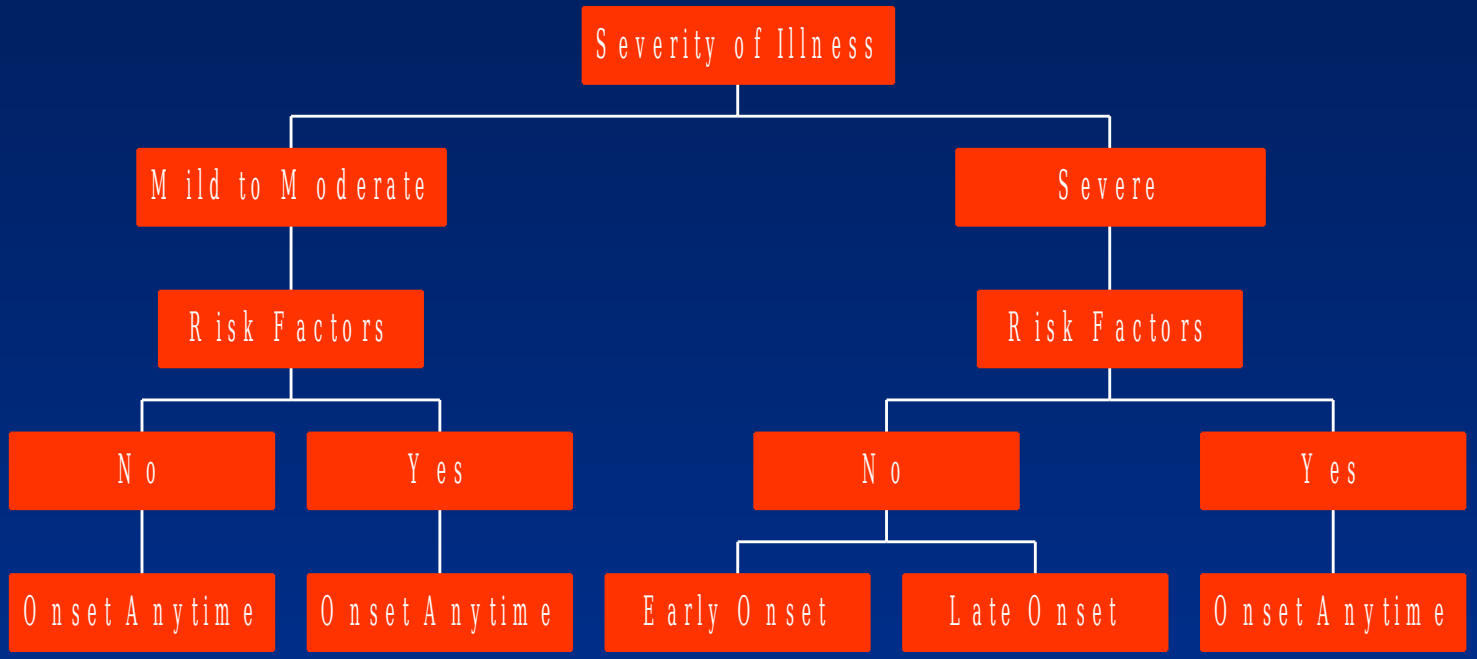
Microbiology

- Spectrum different from CAP
- Organisms depend on:
  - Time of onset
  - Severity
  - Patient-specific factors (e.g. immune status)
- Generally concerned about:
  - EGNB
  - S. aureus
  - Polymicrobial in 50% patients on MV

Classifying patients

- Early onset: < 5 days after admission
- Late onset: > 5 days after admission
- Determine risk factors
- Determine severity

Classifying patients



Risk factors

Pathogen	***Risk factors***
Anarobes	Abdominal surgery, aspiration
S. aureus	Coma, AODM, renal failure
Legionella	Corticosteroids
Psuedomonas	Long ICU stay, corticosteroids, underlying lung dz, prior abx use

Definition of severe HAP

Admission to ICU

Respiratory failure (need for MV)

Rapid CXR progression

Evidence of sepsis or end-organ dysfunction

Microbiology

- Mild to moderate HAP or early severe HAP
  - Enterobacter
  - E coli
  - Proteus
  - Serratia
  - MSSA

Microbiology

- Severe HAP
  - Psuedomonas
  - Acinetobacter
  - MRSA

Microbiology

- Risk factor for S. aureus
  - Coma on admission
  - GCS < 9 for at least 24hrs after admission
  - Absence of corticosteroid tx
  - Recent trauma

Microbiology

- Risk factors for Legionella
  - Malignancy
  - Neutropenia
  - Use of corticosteroids
  - Renal failure
  - Cytotoxic chemotherapy
- No relationship with
  - MS
  - Prior abx use

Diagnosis

- Clinical picture often confusing
- Differential diagnosis broad
- Role for invasive procedure controversial
- No diagnostic approach without problems

CXR

- New infiltrate often required for dx of HAP
- Fever may precede infiltrate
- AP films difficult to interpret in ICU
  - 26% of infiltrates by CT scan missed by CXR
  - If underlying CXR abnormal (e.g. ARDS), locating new process difficult
- Many pneumonia mimics

CXR

Radiographic Mimics of Pneumonia

Aspiration	Alveolar hemorrhage
Atelectasis	Pulmonary edema
ARDS	Pleural effusion
Pulmonary infarct	BOOP

CXR

- Atelectasis
  - Common
  - Resolves within 48 hrs
- Gastric aspiration
  - 50% of alert pts on MV may aspirate
  - 77% asymptomatic despite large volume aspiration

CXR

- No feature allows differentiation of pneumonia from nonpneumonic process
- Correlation between CXR diagnosis and autopsy poor
- Providing radiologist with clinical data may worsen accuracy of CXR

Sputum culture

- Only 33% of patients colonized develop HAP
- Recovery of pathogen from tracheal secretion not diagnostic for pneumonia (exception: Legionella)
- DDx purulent sputum: HAP, sinusitis, tracheobronchitis, aspiration

Sputum culture

- Gram stain
  - If no bacteria, <5% probability HAP
  - If >10/oil immersion field on 50% HAP

Clinical impression

- New infiltrate, purulent secretion +/- fever/leukocytosis: 30% incidence HAP
- Overall MD accuracy: 77%
  - Exclude dx HAP -- 89%
  - Dx HAP -- 62%
- Even if clinical dx HAP correct, incorrect abx in 44% cases

Fagon et al. Chest. 1993: 547

Bronchoscopy

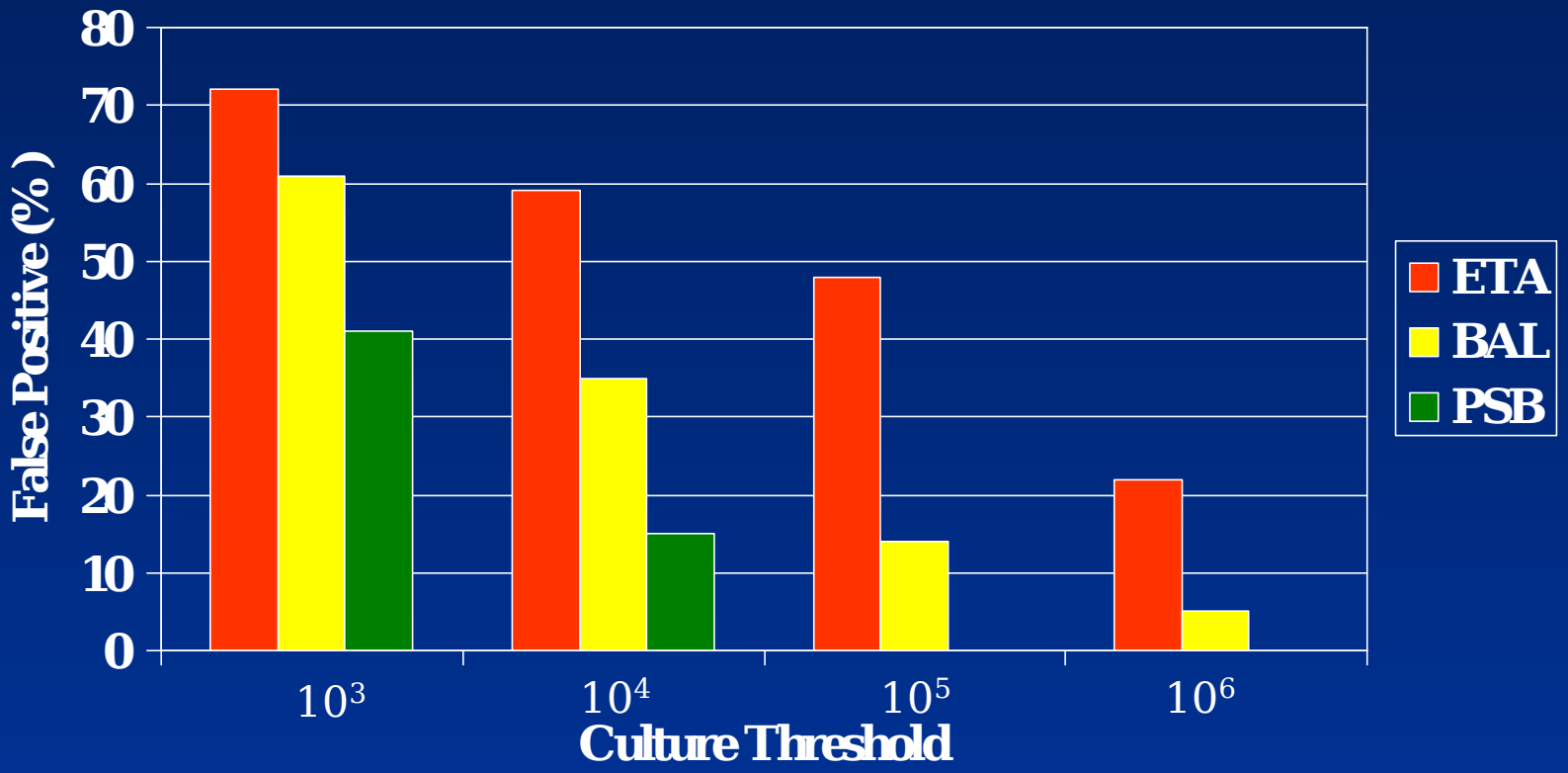
- Two techniques
  - PSB
  - BAL
- Quantitative cultures important
- Prior abx exposure often causes false negatives
- FOB helps excludes pneumonia
- Definition of positive yield has large impact on sensitivity and specificity

Bronchoscopy

- Positive culture: 10^3 or 10^4 CFU
- Pneumonia usually not clinically present unless 10^4 CFU or greater
- Threshold not absolute
- Culture results below threshold may represent early disease
  - 30% of patients with $>10^2$ but $< 10^3$ CFU eventually developed HAP
- Specificity: 90% for BAL and PSB

Bronchoscopy

Specificity and False Positives



Torres et al. ARRD. 1993: 95

Diagnosis

- Sensitivity: 55-75%
- False negative rate raises concern about withholding abx
  - No excess mortality in patients with neg. FOB even if clinical picture c/w HAP

Treatment

- Never use aminoglycoside alone
  - Poor lung penetration
- Quinolones and aminoglycosides have prolonged postantibiotic effect
- Antipseudomonal therapy requires multiple agents
- With appropriate therapy: 70-80% survival

Treatment

Mild to moderate HAP, no unusual risk factors, onset any time or severe HAP with early onset

Core organisms

- EGNB
  - Enterobacter
  - E. coli
  - Klebsiella
  - Proteus
  - Serratia
- MSSA

Core antibiotics

- Cephalosporin
  - 2nd generation or nonpsuedomonal 3rd generation
- Beta lactam/lactamase inhibitor
- Fluroquinolone

Treatment

Mild to moderate HAP with risk factors, onset anytir

Core organisms *Plus*

- Anarobes
- S. aureus
- Legionella
- Pseudomonas

Core antibiotics *Plus*

- Clindamycin or beta lactam/ lactamase inhibitor
- +/- Vancomycin
- Macrolide
- Fluroquinolone

Treatment

Severe HAP

Core organisms, *Plus*

- Pseudomonas
- Acinetobacter
- Consider MRSA

Therapy *(combination of*

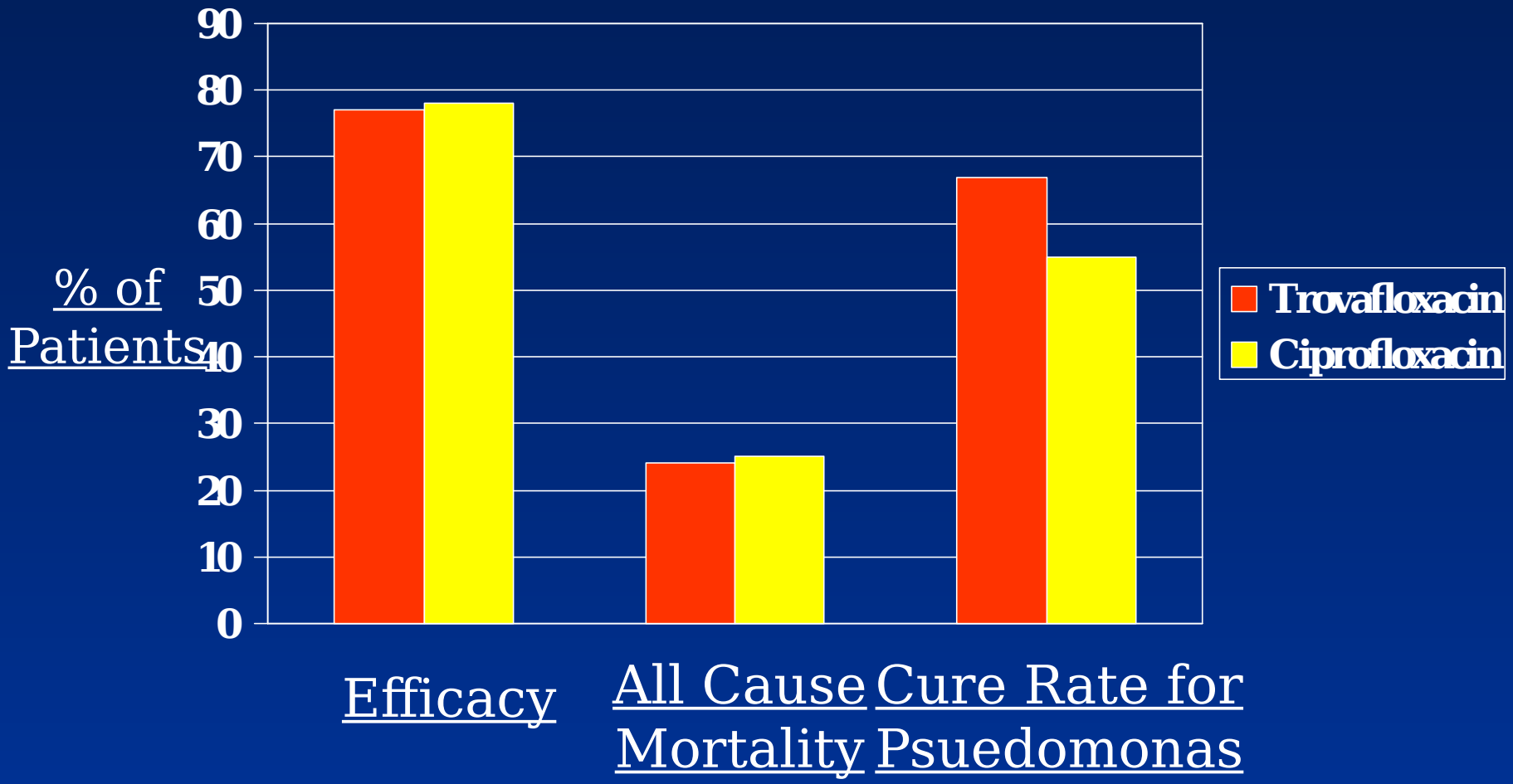
- Aminoglycoside
- Fluroquinolone
- Aztreonam
- Antipsuedomonal PCN or Cephalosporin
- Imipenim (alone)
- +/-Vancomycin

Treatment

- Design: DBRCT, Multicenter
- Patients
  - Clinical dx of nosocomial pneumonia
  - Stratified by severity illness (APACHE II score and need for mechanical ventilation)
- Sample size: n=267
- Intervention
  - Trovafloxacin vs. Ciprofloxacin±Metronidazole or Clindamycin

DR Grahm, et al. ICAC 1998: A 3

Treatment

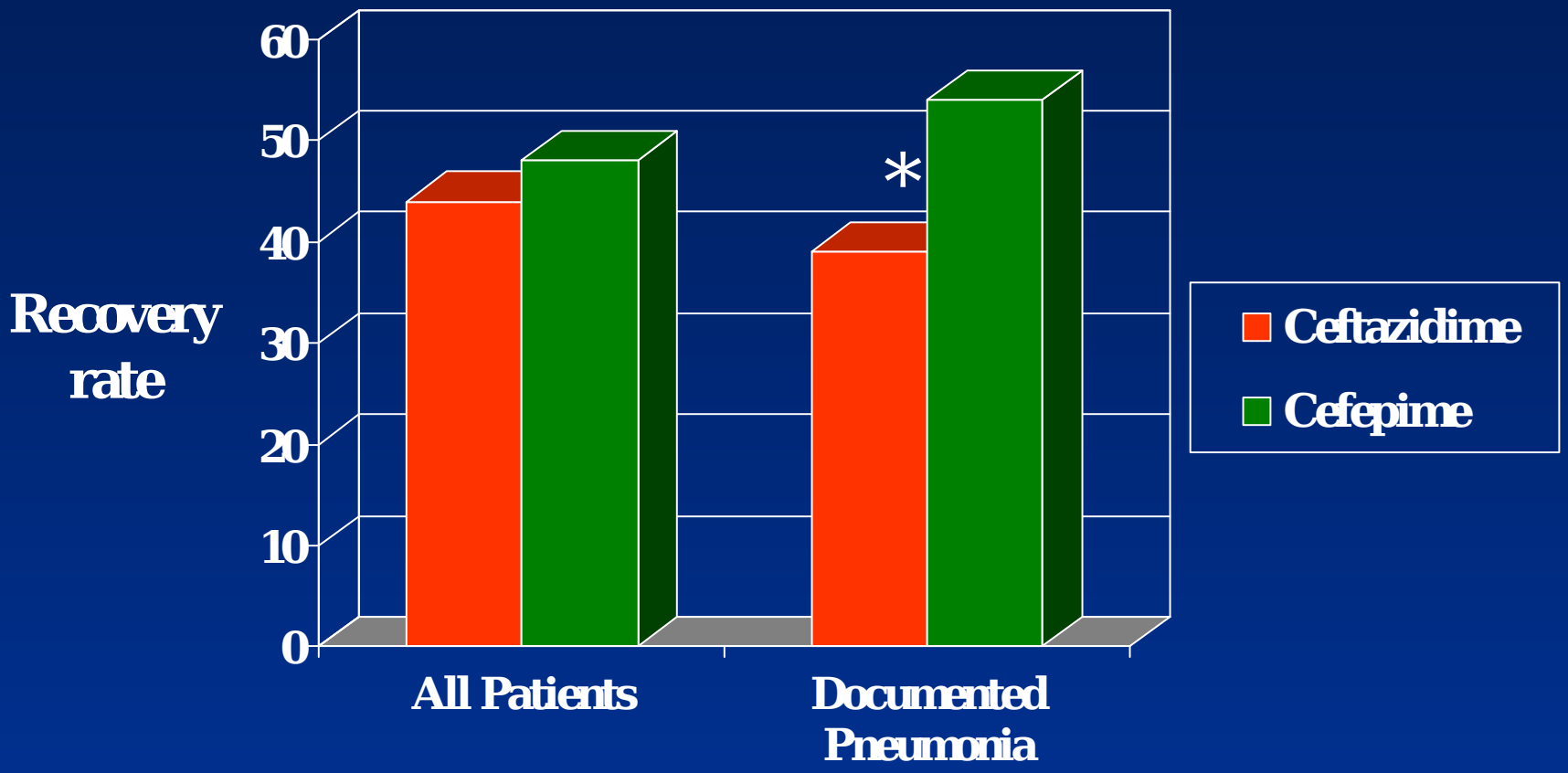

90
80
70
60
50
40
30
20
10
0
% of Patients
Efficacy
All Cause Mortality
Cure Rate for Psuedomonas
Trovafloxacin
Ciprofloxacin

Treatment

- Design: DBRCT, multicenter
- Patients
  - Mechanically ventilated
  - Clinical dx +/- BAL
- Sample size: n=275
- Intervention
  - Cefepime + amikacin vs ceftazidime + amikacin

Beaucaire G, et al. Ann Anesth Reanim 1999;18:

Treatment



* p = 0.05

Drug resistance

- Growing problem
- Carbapenems no longer acceptable monotherapy for VAP
- Historical use of abx likely culprit
- Resistance now an issue for
  - Pseudomonas
  - S. aureus
  - Acinetobacter

Acinetobacter resistance

- Acinetobacter VAP associated with high mortality
- Recent ICU outbreaks of MDR A. baumanni reported
- Major risk factor for infection with A bumanni
  - Ceftazidime use (relative risk 6.0)

Husni RN, et al. CHEST 1999; 115:13

Prevention

- Infection control (hand washing)
- Positioning
  - Semierect position decreases aspiration risk
- Prevent gastric colonization
  - Careful use of stress ulcer prophylaxis
  - Early enteral feeding
- Extubate as soon as ready
- Change vent circuit less frequently

Prevention

Controversial and experimental options

- Choice of ulcer prophylaxis
  - Sucralfate vs ranitidine
- Crop rotation of antibiotics
- Selective gut decontamination
- Use of cytokines
  - G-CSF
  - IFN

Conclusions

- HAP is frequent
- HAP associated with excess mortality
- Pathogens distinct
- Diagnosis is difficult
- Approach to therapy empiric
- Prevent options available